R·I·T

Title: STS ASE

Semiconductor & Microsystems
Fabrication Laboratory **Revision: B** **Rev Date: 03/11/2020**

Approved by:

_____ / / _____ / /
Process Engineer Equipment Engineer

1 SCOPE

The purpose of this document is to detail the use of the STS ASE. All users are expected to have read and understood this document. It is not a substitute for in-person training on the system and is not sufficient to qualify a user on the system. Failure to follow guidelines in this document may result in loss of privileges.

2 REFERENCE DOCUMENTS

- Operator Manual STS ASE (deep Si etch)10-04-2011
- MSDS for Argon gas Ar, Oxygen gas O2, Nitrogen gas N2, Octaflourocyclobutane C4F8, Sulfur Hexaflouride SF6, Helium gas He

3 DEFINITIONS

STS-Surface Technology Systems
ASE- Advanced Silicon Etching
RIE-Reactive Ion Etcher
ICP- Inductively Coupled Plasma
HBC-Helium Backside Cooling
Slice-Wafer Lift Pins
HF-High frequency RF
LF- Low Frequency RF
Clamp-Electrostatic Chuck in Process Chamber

4 TOOLS AND MATERIALS

4.1 General Description

4.1.1 The <STS ASE> deep Si etcher is equipped with a single process chamber. Wafers can be dry-etched using fluorine containing process gasses. The official name Advanced Silicon Etch (ASE) indicates that the tool is limited to the etching of silicon only and this is done according to a special procedure (see below). All processing is done in a closed vacuum system and wafer transportation between a load lock carousel and the process chamber.

5 SAFETY PRECAUTIONS

5.1 Hazard to the Operator

5.1.1 This system uses compressed argon, oxygen, nitrogen, helium, sulfurhexaflouiride(SF6), octaflourocyclobutane(C4F8) gas. Please read and understand the MSDS's before using.

5.1.2 This unit has hazardous voltages and RF radiation inside. Do not operate with the covers off.

5.2 Hazards to the Tool

5.2.1 **Absolutely no metals are allowed in this tool.**

5.2.2 All processing must be approved by the SMFL Operations Manager and SMFL Process Engineer before running. Wafers must be clean and flat with no backside particulate or damage.

5.2.3 Backside contamination, flatness, damage will cause helium backside cooling leakage into the process chamber. If the leakage is too great, the etch will not continue. Any contamination will have to be cleaned, causing excessive tool down time.

6 INSTRUCTIONS

6.1 Initial State Check

6.1.0 Card swipe in on Card Swipe #1.

6.1.1 In service chase 17-2725 ensure that the Helium regulator shows 20PSI on the outlet.

6.1.2 In service chase 17-2725 ensure the gas panel valves labeled STS are on for Ar, O2, C4F8, and SF6.

6.1.3 In service chase 17-2725 ensure that both valves labeled STS on the nitrogen manifold are open.(One is tagged DO NOT SHUT OFF over the valve handle and should show 80PSI on the gage)

6.1.4 In service chase 17-2725 ensure that the two STS water manifolds have all valves open.

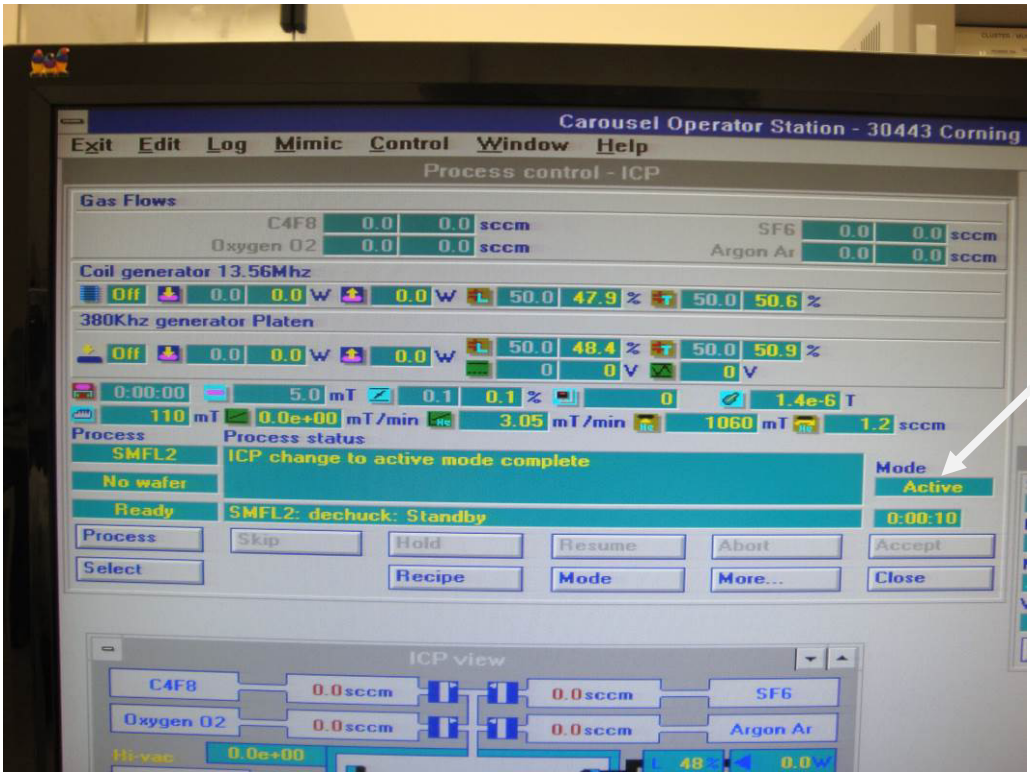
6.1.5 In service chase 17-2725 ensure the chiller is at 20°C and no fault lite or low level water lights are on and the DI water light needs to be green.

DI Water Light

Fault and Level Lights

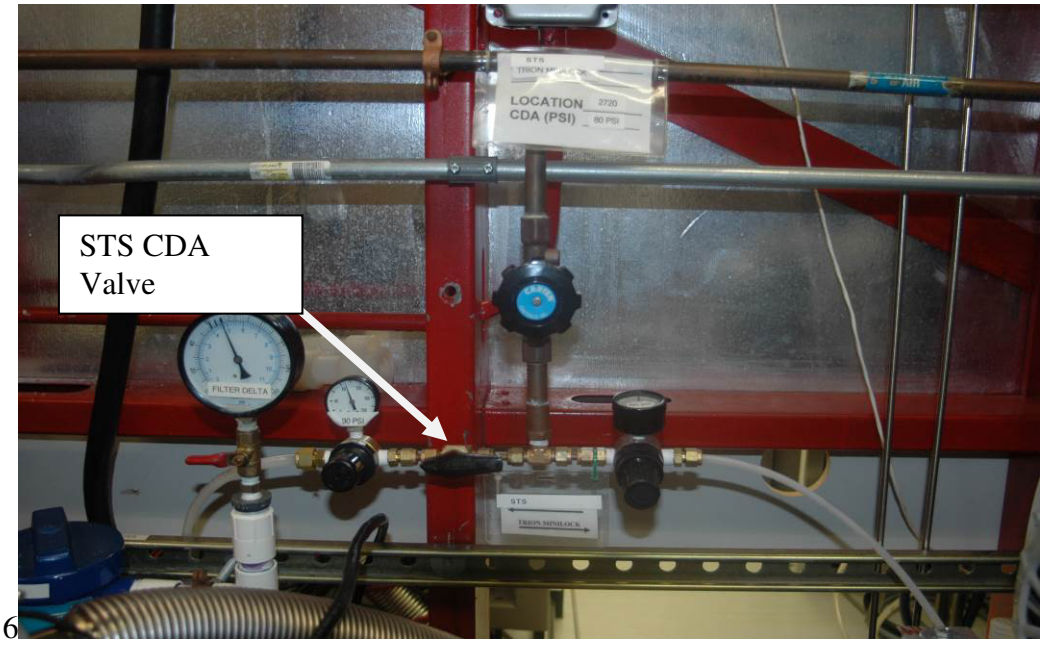
6.1.6 On the control cart the monitor should be on with the five screens showing. Two mimic screens with pictorials of the process chamber and valves and one showing the wafer position. Three control screens with Process Control -ICP on one, Sequencer on one and Transfer/Load Lock controls on the other.

6.1.7 Ensure Active is displayed in the lower right side of the Process Control-ICP Screen.

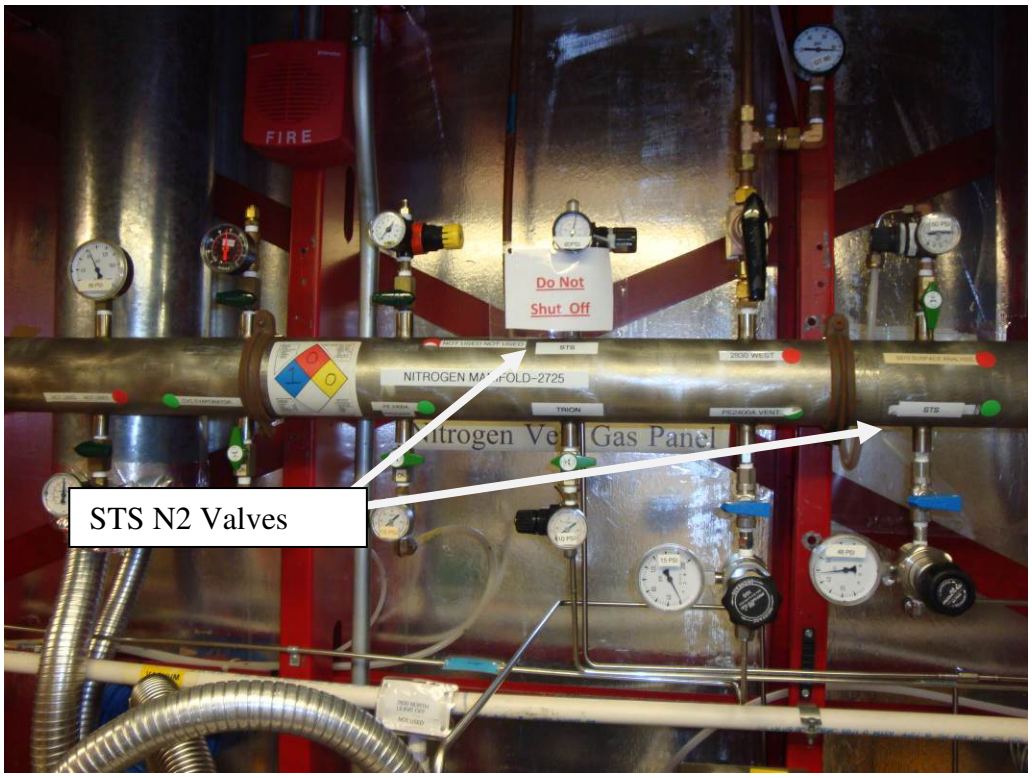


6.1.8 Ensure the Interlock Display IDL4 on the electronics rack shows Flashing RF Interlock followed by a steady Clamp On.

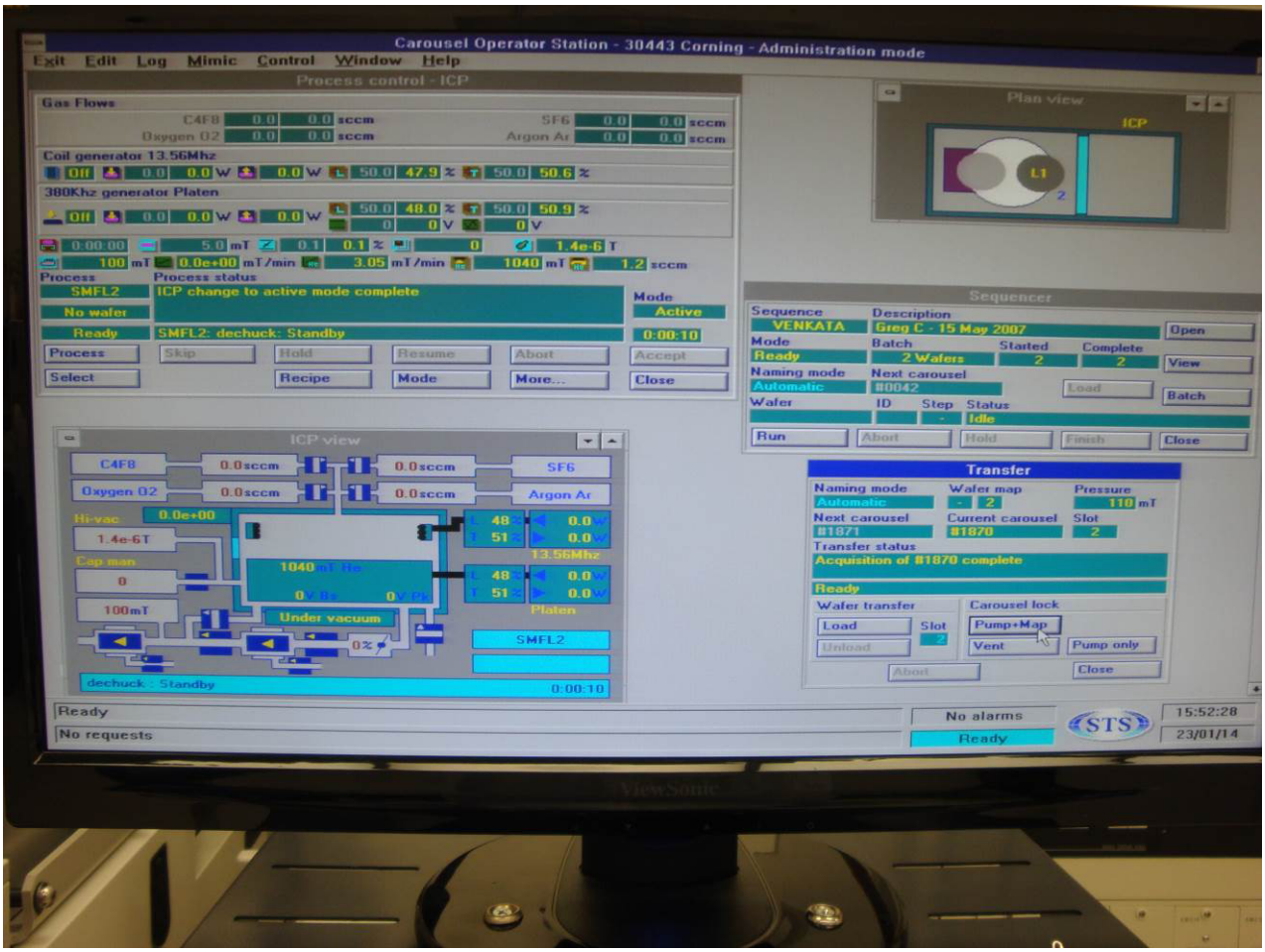
Four gas panels and He bottle regulator



6



N2 Manifold



Control and Mimic Screens

6.2 Wafer Loading

6.2.1 Put switch (9) on VAC3Y panel into LOAD/RUN position.

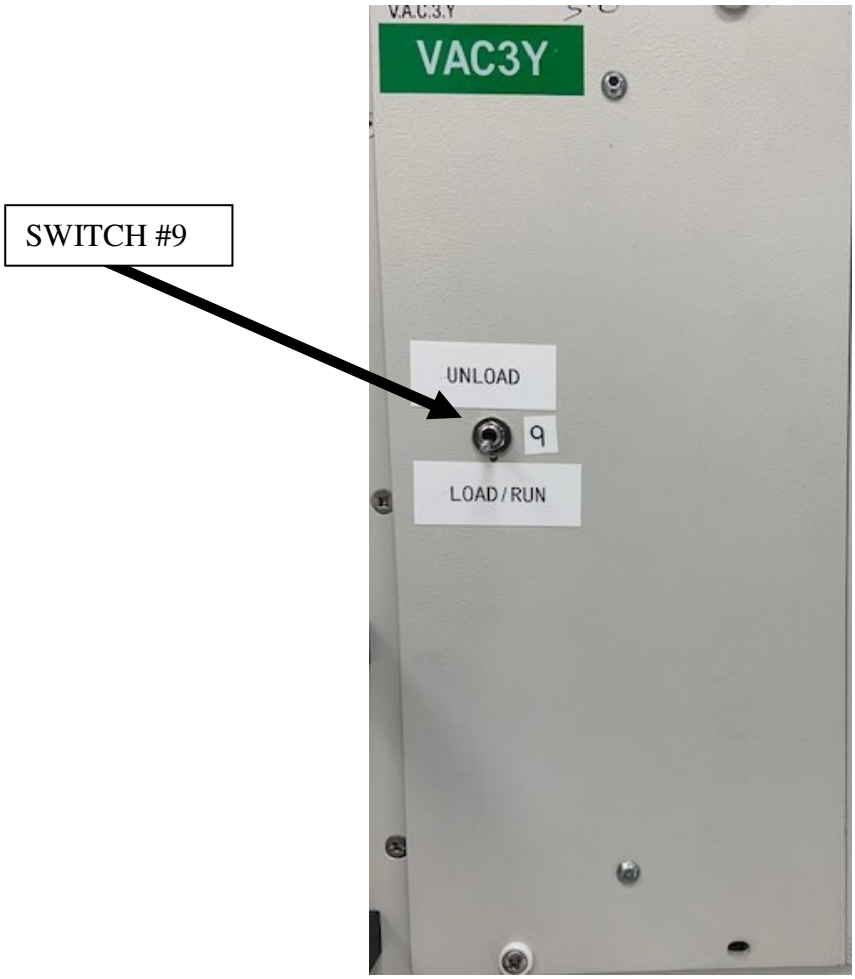


Figure 10 VAC3Y MODULE

6.2.2 Inspect the wafer backside for contamination and damage.
6.2.3 Vent the load lock by selecting VENT on the Transfer Control Screen using the right mouse button.
6.2.4 Open the load lock and place your wafer/wafers on the carousel with the flats aligned with the marks on the carousel.
6.2.5 Ensure the 150mm ceramic ring is seated properly on the carousel.
6.2.6 Close and latch the load lock and select PUMP and MAP on the Transfer Control Screen
6.2.7 . When PUMP and Map are done LOAD will be activated (Fig. 1 Transfer Mimic)

6.2.8 Check that SLOT number coincides with WAFER MAP number on Transfer Screen.
6.2.9 Press LOAD. Wafer will be put into process chamber. If wafer doesn't move, ensure that SLOT number and WAFER MAP are the same.
6.2.10 PROCESS and SELECT will become active when wafer transfer is complete.

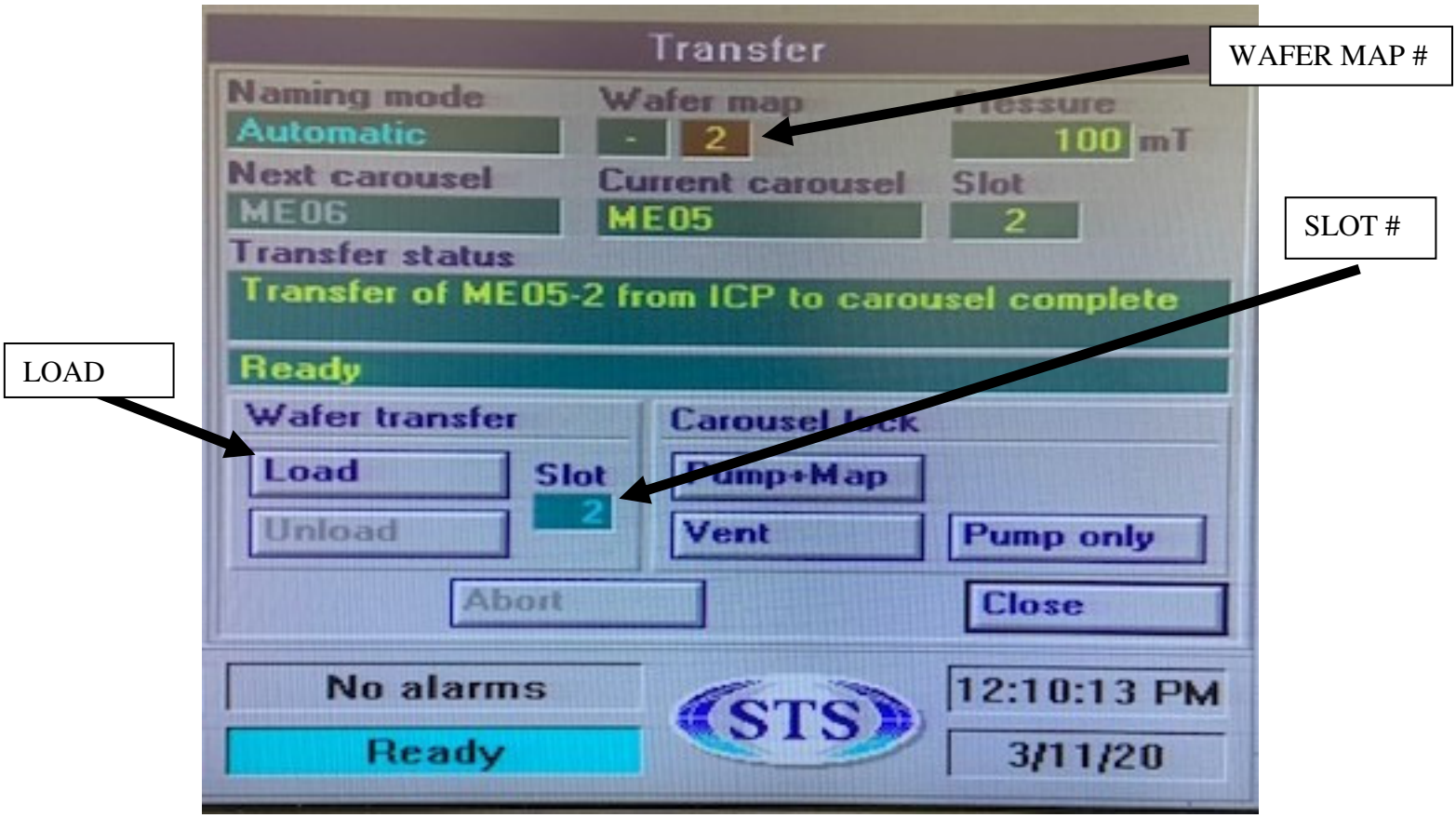
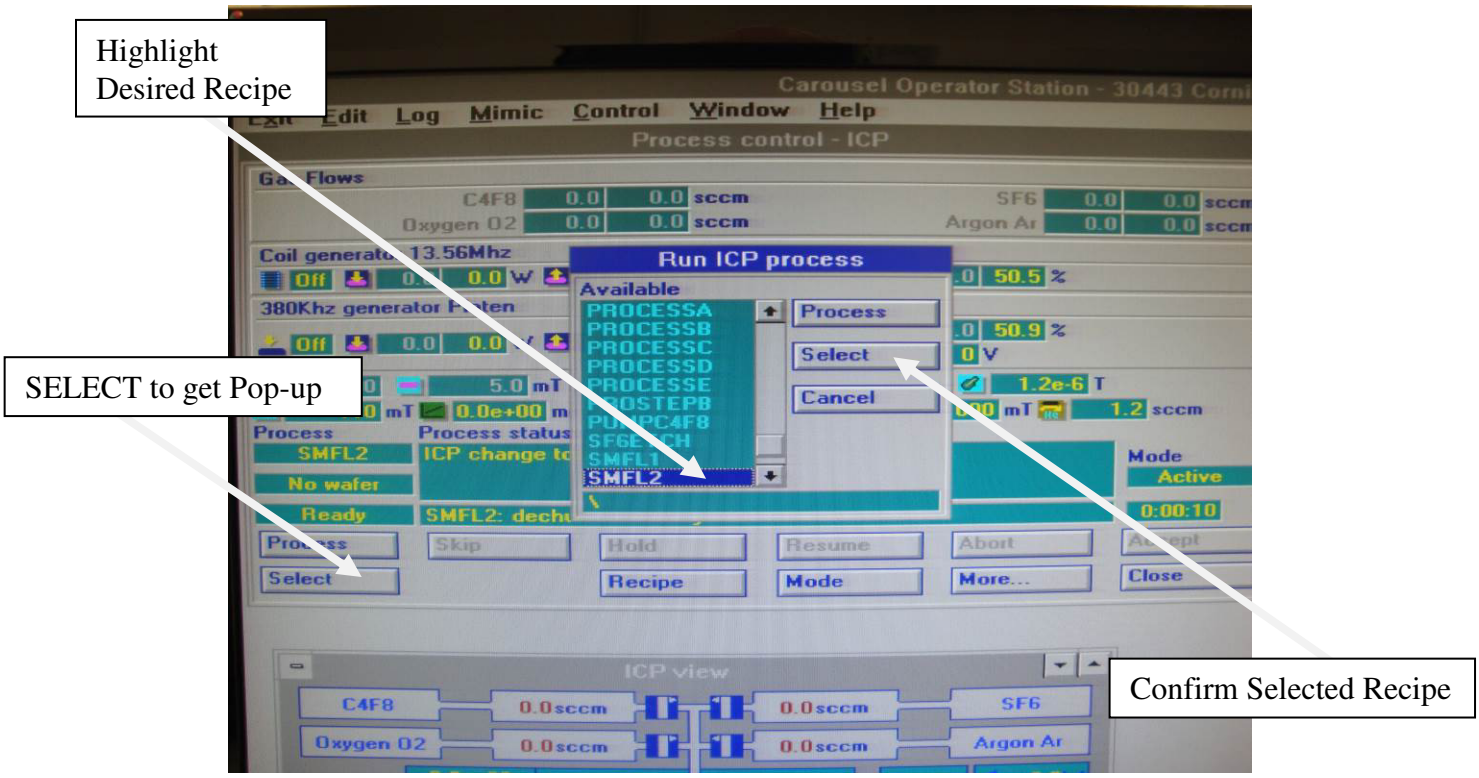


Figure 2 Transfer Mimic

6.3 Select Recipe

6.3.1 On the Process Control-ICP screen click on the SELECT button and a pop up window with a list of recipes will appear. Select the recipe desired.



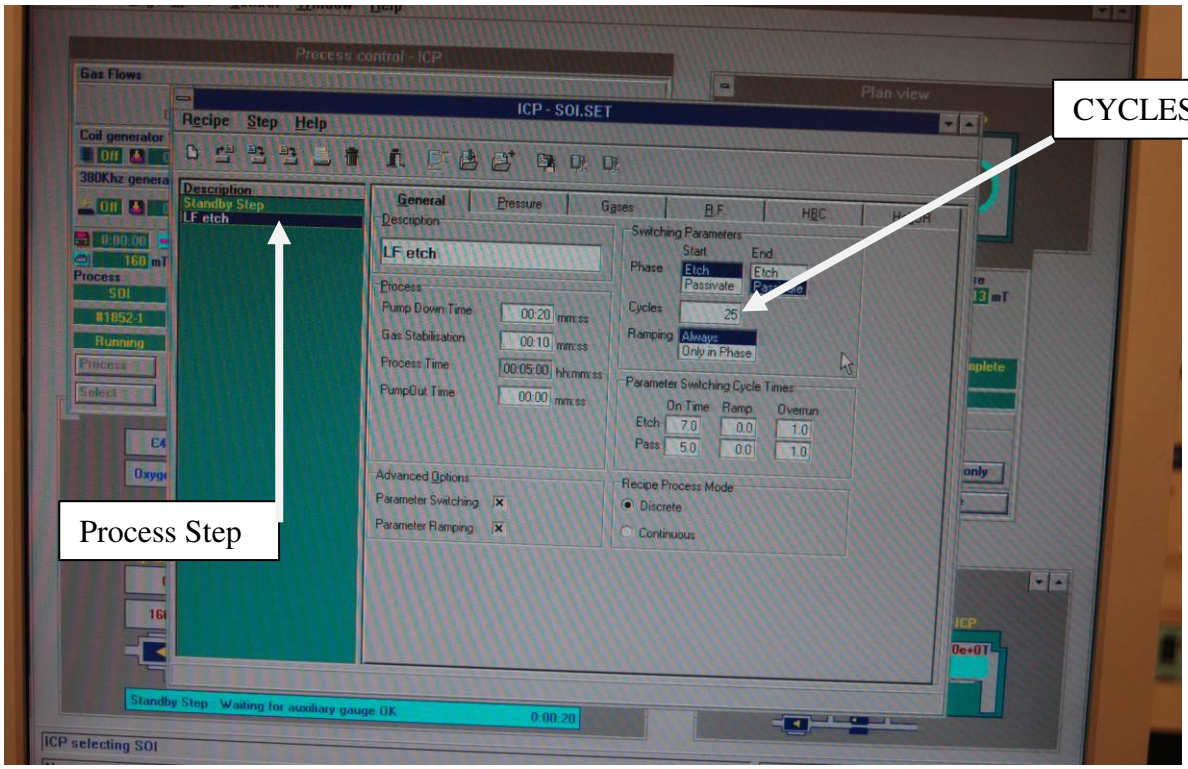
6.3.2 Confirm your selection by clicking on SELECT in the pop up window. The system will prepare the chamber for processing (purge and pump, chamber colored blue on the PLAN view) and then wait for further commands. On the Process Control-ICP screen

The recipe you selected should be displayed in Yellow under PROCESS on the left of the screen.

CAUTION: If you accidently press Process in the pop up window, the selected process will start. If you don't want this press Abort in the Process Control-ICP window immediately and the process will stop and switch to standby.

6.3.3 On the Process Control-ICP screen press RECIPE to enter the Recipe Editor.

6.3.4 In the recipe ignore the Standby Step. The process steps follow after it. The only parameter you are allowed to change is the CYCLE. Each recipe is characterized to provide certain etch depth and side wall characteristics. Change the cycle count to reach your desired depth but do not change the etch and passivate / deposition step times. They are matched by design. Most recipes are Bosch processes with parameter cycling, each cycle including an etch step and deposition/passivation step. The editor will automatically round the process time to the nearest complete cycle. Select the process step and edit the cycle count for the desired etch depth.



6.3.5 Once CYCLE is edited, save by either RECIPE/SAVE or RECIPE/CLOSE or by using the corresponding icons.

6.3.6 On the Process Control-ICP screen press SELECT again to load the edited changes.

6.4 Run an Etch Process

6.4.1 After loading a wafer and selecting a recipe and adjusting the cycle count for the desired depth, the etch can be started by pressing PROCESS on the PROCESS CONTROL – ICP- window.

NOTE: Each process run starts with a standby step which prepares the chamber for the selected process. The process chamber shows blue at this time. Before the process starts the helium leak-up rate is checked and if it leaks beyond 5mT/min the wafer is not accepted for processing (alarm). If this happens, then the wafer may be dirty or the wafer may be damaged or warped. Always abort the run and remove the wafer by pressing Abort if the wafer is rejected. Inspect the wafer after removal and correct the issue. If the electrostatic chuck becomes contaminated the chamber must be cooled down and disassembled to clean the chuck and excessive tool down time will result.

6.4.2 Once the plasma ignites the chamber displays pink on the screen. If you have to Interrupt the process press HOLD (plasma off). If you wish to continue press RESUME (plasma on), but it is not recommended unless there is an emergency.

6.4.3 You can end a step by pressing SKIP. The process will continue with the next Process step (if the recipe has one) or return to Standby if it is the final step.

6.4.4 When the process time is up, the process automatically ends with the Standby step and prepares the chamber for wafer unload.

6.5 Wafer Unloading

6.5.1 To UNLOAD the wafer place SWITCH #9 on the VAC3Y to UNLOAD.

6.5.2 On the TRANFER SCREEN (Fig1 Transfer Mimic) select UNLOAD

6.5.3 Unit will now run DECHUCK and remove wafer from process chamber.

6.5.4 If DECHUCK does not start, ensure that SWITCH #9 is in UNLOAD position. GET TECHNICIAN at this point.

6.5.5 To open the Load Lock press VENT on the Transfer/Load Lock screen. The latch will allow the load lock to open once it reaches atmospheric pressure.

6.5.6 Upon completion of all processing, with all the wafers removed from the tool, close the lid and press PUMP ONLY on the Carousel Lock quadrant of the Transfer/Load Lock Screen. This will keep the load lock under vacuum, clean and ready for the next user.

7.0 Shut Down

7.0.1 Card swipe out. The user shut down is fully automated by the card swipe.

7.0.2 Fill in the user log on tool

REVISION RECORD

Summary of Changes	Originator	Rev/Date
Original Issue	B. Tolleson	01/21/2014
B – Operating Revisions	R. Battaglia	03/11/2020